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much to remind the reader of the Weissnichtwo Professor of Things in General; for students who have difficulty in seeing a number of sides to the same question the book will surely be an inspiration. Among the topics discussed are: the relation between material and form throughout nature; metamorphosis and substitution; the relation of species, variety, and race; phylogeny; paleobotany, etc.

The work has an almost medieval smack; after a few introductory pages it is written entirely in dialogue, which may make it tedious for him who is only after the kernel of the nut. There is no doubt, however, that the reader's interest is held by these curiously learned dialogues of Fritz, Hans, and the other students, albeit the ludicrous will occasionally arise to obscure the scientific.—B. E. LIVINGSTON.

MINOR NOTICES.

TREES, SHRUBS, and VINES[5] is a book designed especially for New Yorkers, and to them it may be useful. Though it professes to describe these plants in all the northeastern United States, this part is distinctly inferior and secondary. The greater part of the book is devoted to lists of "these three growths" and to "rambles" in Central Park, whose glories are fully exploited. To a brief description of native trees, shrubs, and vines 172 pages are devoted, and nearly half as much more to the foreign species grown in Central Park. The descriptions are too brief, lacking in contrasts, and often maddeningly comparative. Species of the same genus are often widely separated. The keys are worthless; *e. g.*, one of the chief distinctions is "widely distributed within territory" and "found only on frontier"—exactly the kind of information that one endeavoring to name an unknown tree is unlikely to possess. If the book sailed under true colors it would be more commendable; but judged according to its title it is far inferior to others of like purpose.—C. R. B.

NOTES FOR STUDENTS.

DUDE,[6] studying both fungi and higher plants, finds that the replacement of oxygen by purified hydrogen can be withstood by spores and seeds for a long time (in seeds fifteen to fifty days), but that their germination is much delayed. The vegetative tissues are injured irreparably after an hour or at most a few hours, the younger being most easily killed; yet meristematic tissues endure the hydrogen for three to five days. In all conditions a higher temperature accelerates the action.—C. R. B.

DR. B. LONGO[7] holds that the pollen tube is the only channel by which the embryo of Cucurbita can receive nutriment, because of the marked cutinization of the cell walls in the chalazal region and of the nucellar epidermis, which is completed while yet the embryo is spherical. The only pervious point is at the tip of the nucellus, where the pollen tube forms a globular swelling and sends branches through the inner integument which extend into the outer. These branches collect the food from the integuments, which are in communication with the nutritive tissues by the vascular bundles, and through the pollen tube it travels to the embryo.—C. R. B.

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[5] PARKHURST, H. E., Trees, shrubs, and vines of the northeastern United States. 12mo. pp. viii + 451: Illustrated. New York: Charles Scribner's Sons. 1903. $1.50.

[6] DUDE, MAX, Ueber den Einfluss des Sauerstoffsentzuges auf pflanzliche Organismen. Flora **92**: 205-252. 1903.

[7] LONGO, B., La nutrizione dell' embrione delle Cucurbita operata per mezzo del tubetto pollinico. Annali di Botanica **1**: 71-74. 1903.

VINES finds[8] that Buscalioni and Fermi had anticipated some of his studies upon proteolytic enzymes, having determined in 1898[9] by a different method entirely the rather extensive occurrence of such enzymes. In this second paper Vines summarizes their results and contributes further data. He shows that the antiseptic used may influence greatly the digestion (which explains Mendel and Underhill's results with papain); corrects Buscalioni and Fermi's determination that dahlia roots are proteolytically inactive; and finds an enzyme in *Crambe maritima* which belongs to the erepsin group of proteases.—C. R. B.

IN A SERIES of researches on the physiology and morphology of alcoholic ferments, Hansen[10] shows that in beer cultures Saccharomyces spores may develop into sporangia without vegetative division. They simply enlarge enormously and develop new spores in their interior. The maximum and minimum temperatures for growth as well as for sporulation in a number of species of Saccharomyces are given. Temperature does not seem to affect the formation of spores directly; the latter are formed with full access of oxygen and fail to be formed in its absence. Many special variations in the behavior of the different species are noted. Lack of nutriment checks growth, and under certain other conditions may appear to lead to spore production, but it is not itself a cause for this. Several other fungi are considered. Among other points, it is noted that Mucor produces zygospores under the same general conditions as those under which it produces sporangia, but that zygospores need more oxygen for their formation.—B. E. LIVINGSTON.

SPINDLE FORMATION at the first division of the pollen mother-cell of *Larix europaea* DC. has been described in great detail by Dr. Allen.[11] Late in October the pollen mother-cells are easily distinguished, but division does not occur until the following spring. Five stages in the formation of the spindle are described, viz., the preradial stages, the radial stages, formation of the felt, the multipolar spindle, and the completion of the spindle. The conclusion is reached that, from the very early prophases, there is present in the cytoplasm a distinct fibrous system which, in conjunction with another set of fibers of nuclear origin, forms the spindle. The fibers of an early reticulum become arranged into a radial system ; this in large part passes into an extra-nuclear felt, and the fibers of the felt form the extra-nuclear portions of the spindle. The fibers are something more than lines of force or expressions of strains or stresses. They are organs with distinct chemical and physical properties which determine their power to do particular kinds of work. No centrosomes were observed at any stage in mitosis.— CHARLES J. CHAMBERLAIN.

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[8] VINES, S. H. Proteolytic enzymes in plants. II. Annals of Botany 17:597–616. 1903.

[9] BUSCALIONI and FERMI, Studio degli enzimi proteolytici e peptonizzanti dei vegetali. Annuario R. Ist. Bot. Roma 7:99. 1898.

[10] HANSEN, E. C., Recherches sur la physiologie et la morphologie des ferments alcoholiques. Compt. Rend. Labor. Carlsberg 5:69–107. *figs. 4.* 1902.

[11] ALLEN, C. E., The early stages of spindle formation in the pollen mother-cells of Larix. Ann. Botany 17:281–312. *pls. 14–15.* 1903.

H. O. JUEL[12] has recently studied the development of the megaspore in Casuarina, basing his results upon material of an undetermined species collected in Algeria in January 1901, and material of *C. quadrivalvis* collected at Naples in March of the same year. The principal results are as follows: Each of the numerous embryo sac mother-cells, by two successive divisions, gives rise to four megaspores. The cells of the archesporium are distinguished by their larger nuclei and denser contents. The first nuclear division in the megaspore mother-cell is marked by the usual synapsis stage and by a reduction in the number of chromosomes. The number of chromosomes at this divison was not determined definitely, but was not less than eight nor more than twelve, while the number in sporophytic cells was about twice as large. Bodies of kinoplasmic aspect appear at or beyond the poles of the spindle during the mitoses which give rise to the four megaspores, but these bodies are not regarded as centrospheres. They resemble the dense areas which have been described in various gymnosperms. The later stages were not studied, but the writer remarks that in regard to the development of the embryo sac, the entrance of the pollen tube and the formation of the embryo, he can only confirm the account of Treub.— CHARLES J. CHAMBERLAIN.

THE REINVESTIGATION of the fossil, *Williamsonia gigas* Carr.,[13] was suggested by Wieland's researches upon Cycadoidea, and there seems to be considerable resemblance between the two forms.

According to the present account, the structures in *Williamsonia gigas* which have been described as "male flowers" are really the axes of ovulate strobili from which the layer of ovules has become detached after maturity. The staminate structures were probably comparable to those described by

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[12] JUEL, H. O., Ein Beitrag zur Entwickelungsgeschichte der Samenanlage von Casuarina. Flora **92**: 284–293. *pl 8.* 1903.

[13] LIGNIER, O., Le fruit du *Williamsonia gigas* Carr. et les Bennettitales, documents nouveaux et notes critique. Mémoires de la Société Linnéenne de Normandie **21**: 19–56. *figs. 9.* 1903.

Wieland for *Cycadoidea ingens.* The fruit of the Bennettitales should be considered, not as a flower, but as an inflorescence.

A diagram showing the relationships of great groups is submitted. From the Protopteridea, the ancestors of the Filicales, is derived a stock which becomes differentiated into two main lines, the Salisburiales and Cordaitales.

At an early period the Cycadales were derived from the Salisburiales and, later, the Coniferales came from the same stock. From the Cordaitales at an early period came the Bennettitales and, later, the Gnetales and Angiosperms. More must be known of the life history of fossil forms lying between pteridophytes and gymnosperms, and also of fossils in these two groups, before a satisfactory diagram of relationships can be constructed.—CHARLES J. CHAMBERLAIN.

ACCORDING TO THE INVESTIGATIONS of J. Brzezinski,[14] the canker disease of trees, long attributed to *Nectria ditissima*, is never caused by this fungus, which, in the opinion of the author, is merely a saprophyte on dead portions of the bark. Inoculations from pure cultures of Nectria failed to produce the disease. The author regards certain bacteria which he found growing in the wood as the true cause of the injury. Three species are described, viz., *Bacterium mali*, *B. pyri*, and *B. coryli*, growing respectively on apple, pear, and hazel. They differ but slightly in cultural characteristics. Inoculations of *B. mali* and *B. pyri* in the wood of apple and pear, respectively, produced discolored areas which gradually extended for a period of several years, forming darkened lines in the wood. In three instances only were small cankers produced on apple trees. The author regards the canker wound merely as one of the external manifestations of the bacteriosis from which the tree is suffering. The disease may manifest itself also as general bacteriosis causing a sickly appearance of the whole tree and producing chlorosis in pear trees. Further, irregular knots on the limbs, a form of twig blight, and root knots are regarded as manifestations of the disease. The twig blight seems to resemble the disease produced on young apple twigs by *Bacillus amylovorus* Burrill. The root knots referred to are "crown galls."—H. HASSELBRING.

PAUL discusses the functions of the rhizoids of mosses and announces certain conclusions,[15] which the writer has held and taught for a number of years, as a result of his observation of the structure and development of these organs. Paul brings no experimental evidence, but relies on more extensive data of the same kind. He holds that the chief function of rhizoids is anchorage; as accessory functions he recognizes (1) the capillary storage and conduction of water by felted rhizoids, and (2) the absorption of water and solutes as by any other part of the body. The support for this view is found in the fact that where anchoring organs are most needed there they are developed, and with evident adaptations in form and length of filament to surface and texture of substratum. In epiphytic and rock species they are best developed; in streaming mosses they form a dense tuft with strongly thickened walls, probably variable according to speed of current; but free floating species have no rhizoids. Paul questions the existence of saprophytic mosses, holding that of such species most grow well also on other sub-strata; that the solution of vegetable membranes by rhizoids is improbable; that penetration is made possible by the pioneer activity of other organisms; and that the nutritive activity of the protonema and leaves is adequate. He finds no evidence that the rhizoids of rock species in any way attack or destroy the rocks by secretions. What disintegration they produce is by holding water. He expressly disclaims denying absorption of water and solutes by rhizoids, but holds that this is only such (or even not so much) as other parts of the body do. No secretions by rhizoids dissolve the substratum. Rhizoids are therefore by no means equivalent physiologically to root hairs. —C. R. B.

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[14] BRZEZINSKI, J., Le chancre des arbres, ses causes et ses symptomes. Bull. Acad. Sci. de Cracovie **1903**: 95–143. *pls. 2–8.*

[15] PAUL, H., Beiträge zur Biologie der Laubmoosrhizoiden. Bot. Jahrb. System. **32**: 231–274. 1903.